

## Claims

What is claimed:

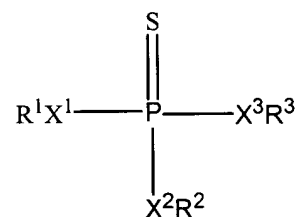
1. An additive concentrate, comprising:
  - a) an extreme pressure compound comprising a sulfur-containing compound;
  - b) load carrying capacity enhancing combination including (i) a hydrocarbylamine compound and (ii) an alkylphosphorothioate compound;
  - c) a friction modifying compound; and
  - d) a diluent oil,

wherein any of compounds a), b)(i), b)(ii), and c) can be the same or different compounds with the proviso that b)(i) and b)(ii) are different.

2. The additive concentrate according to claim 1, wherein the hydrocarbylamine compound comprises an N-aliphatic hydrocarbyl-substituted trimethylenediamine wherein the N-aliphatic hydrocarbyl-substituent comprises at least one straight chain aliphatic hydrocarbyl group free of acetylenic unsaturation and having about 14 to about 20 carbon atoms.

3. The additive concentrate according to claim 1, wherein the hydrocarbylamine compound is selected from the group consisting of N-oleyl-trimethylene diamine, N-tallow-trimethylene diamine, N-coco-trimethylene diamine, and combinations thereof.

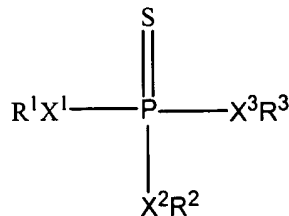
4. The additive concentrate according to claim 1, wherein the alkylphosphorothioate compound is generally represented by the formula:



where each of  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  is, independently, a substituted or nonsubstituted alkyl group or a hydrogen atom, and where at least one of  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  is a substituted or nonsubstituted alkyl group, and where each of  $\text{X}^1$ ,  $\text{X}^2$ , and  $\text{X}^3$  is, independently, an oxygen atom or a sulfur atom.

5. The additive concentrate according to claim 4, wherein each of  $X^1$ ,  $X^2$ , and  $X^3$  represents an oxygen atom, and at least one of  $R^1$ ,  $R^2$ , and  $R^3$  is an unsubstituted aliphatic alkyl group of 3 to 20 carbon atoms.
6. The additive concentrate according to claim 1, comprising about 20 to about 60 wt.% extreme pressure compound comprising a sulfur-containing compound; about 10 to about 30 wt.% hydrocarbylamine compound; about 10 to about 30 wt.% alkylphosphorothioate compound; about 10 to about 30 wt.% friction modifying compound; and a minor amount of diluent oil.
7. The additive concentrate according to claim 1, wherein the extreme-pressure agent comprises a metal-free sulfur-containing extreme-pressure agent selected from the group consisting of sulfurized olefin, and polysulfide composed of one or more groups represented by the formula  $R_a-S_x-R_b$  where  $R_a$  and  $R_b$  are hydrocarbyl groups each of which contains 3 to 18 carbon atoms and  $x$  is in the range of from 2 to 8.
8. A composition, comprising:
  - a) an extreme pressure compound comprising a sulfur-containing compound;
  - b) a load carrying capacity enhancing combination including (i) a hydrocarbylamine compound and (ii) an alkylphosphorothioate compound;
  - c) a friction modifying compound; and
  - d) base oil,
 wherein any of compounds a), b)(i), b)(ii), and c) can be the same or different compounds with the proviso that b)(i) and b)(ii) are different.
9. The composition according to claim 8, wherein the hydrocarbylamine compound comprises an N-aliphatic hydrocarbyl-substituted trimethylenediamine wherein the N-aliphatic hydrocarbyl-substituent comprises at least one straight chain aliphatic hydrocarbyl group free of acetylenic unsaturation and having about 14 to about 20 carbon atoms.
10. The composition according to claim 8, wherein the hydrocarbylamine compound is selected from the group consisting of N-oleyl-trimethylene diamine, N-tallow-trimethylene diamine, N-coco-trimethylene diamine, and combinations thereof.

11. The composition according to claim 8, wherein the alkylphosphorothioate compound is generally represented by the formula:



where each of  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  is, independently, a substituted or nonsubstituted alkyl group or a hydrogen atom, and where at least one of  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  is a substituted or nonsubstituted alkyl group, and where each of  $\text{X}^1$ ,  $\text{X}^2$ , and  $\text{X}^3$  is, independently, an oxygen atom or a sulfur atom.

12. The composition according to claim 11, wherein each of  $\text{X}^1$ ,  $\text{X}^2$ , and  $\text{X}^3$  represents an oxygen atom, and at least one of  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  is an unsubstituted aliphatic alkyl group of 3 to 20 carbon atoms.

13. A composition according to claim 8, comprising about 0.5 to about 2.5 wt.% extreme pressure compound comprising a sulfur-containing compound; about 0.1 to about 1.0 wt.% hydrocarbylamine compound; about 0.1 to about 1.0 wt.% alkylphosphorothioate compound; about 0.1 to about 1.0 wt.% friction modifying compound; and a major amount of base oil.

14. The composition according to claim 8, wherein the extreme-pressure agent comprises a metal-free sulfur-containing extreme-pressure agent selected from the group consisting of sulfurized olefin, and polysulfide composed of one or more groups represented by the formula  $\text{R}_a-\text{S}_x-\text{R}_b$  where  $\text{R}_a$  and  $\text{R}_b$  are hydrocarbyl groups each of which contains 3 to 18 carbon atoms and  $x$  is in the range of from 2 to 8.

15. The composition according to claim 8, wherein the composition has a kinematic viscosity of at least 12 cSt at 100EC.

16. The composition according to claim 8, wherein the base oil has a viscosity in the range of SAE 50 to SAE 250.

17. The composition according to claim 8, wherein the base oil has a viscosity in the range of SAE 70W to SAE 140.
18. A method of manufacturing a composition comprising blending base oil; an extreme pressure compound comprising a sulfur-containing compound; a hydrocarbylamine compound; an alkylphosphorothioate compound; and a friction modifying compound.
19. A method of lubricating a gear comprising using as the lubricant for said gear a gear oil composition according to claim 8.
20. A lubed gear-box comprising a gear within the gear box, in which the gear is lubricated according to the method of claim 19.
21. A method of lubricating a wind turbine gear assembly comprising using as the lubricant for said gear assembly a composition according to claim 8.
22. A wind turbine gear assembly lubricated with a composition according to claim 8.